

Designing mixed-culture bioprocesses by means of bioenergetics models

BIOCHEM project: Designing mixed-culture processes for a circular economy

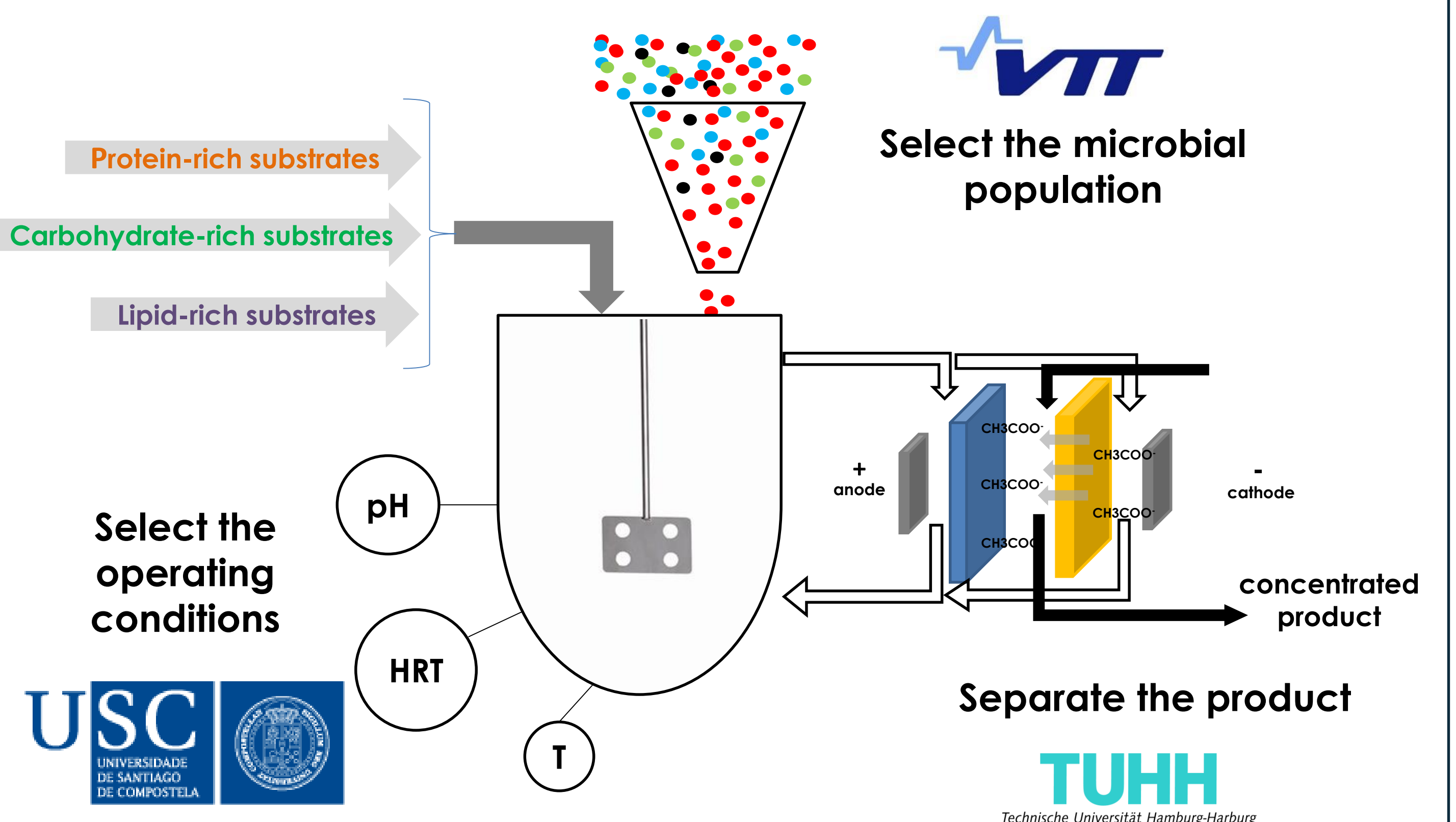
Mixed culture processes



- No sterilisation ● ● Complex and not fully understood
- Treat complex substrates ● ● Very variable outcome
- Robust ● ● Novel bioprocesses are hard to design

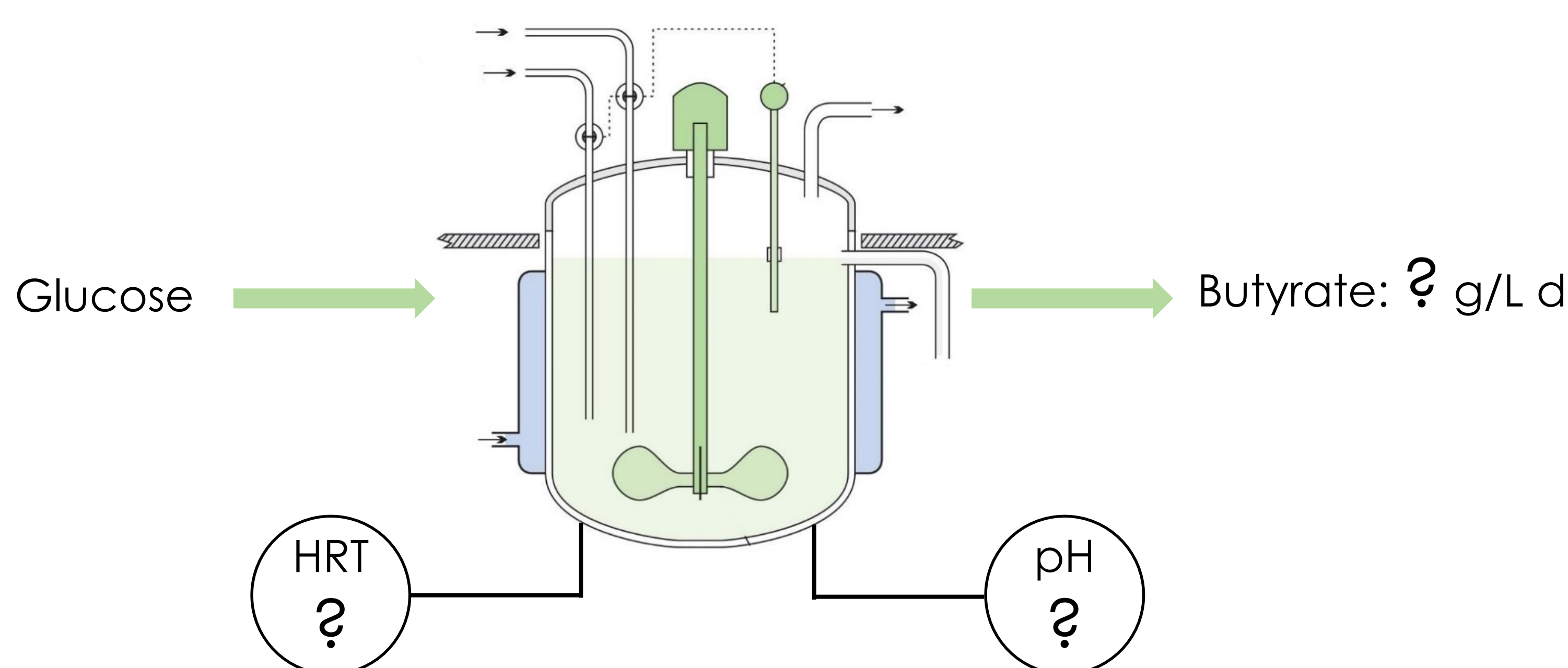
The design of a bioprocess that uses a mixed culture is a hard task. BIOCHEM tackles this issue with a special focus on the use of modelling tools.

BIOCHEM APPROACH

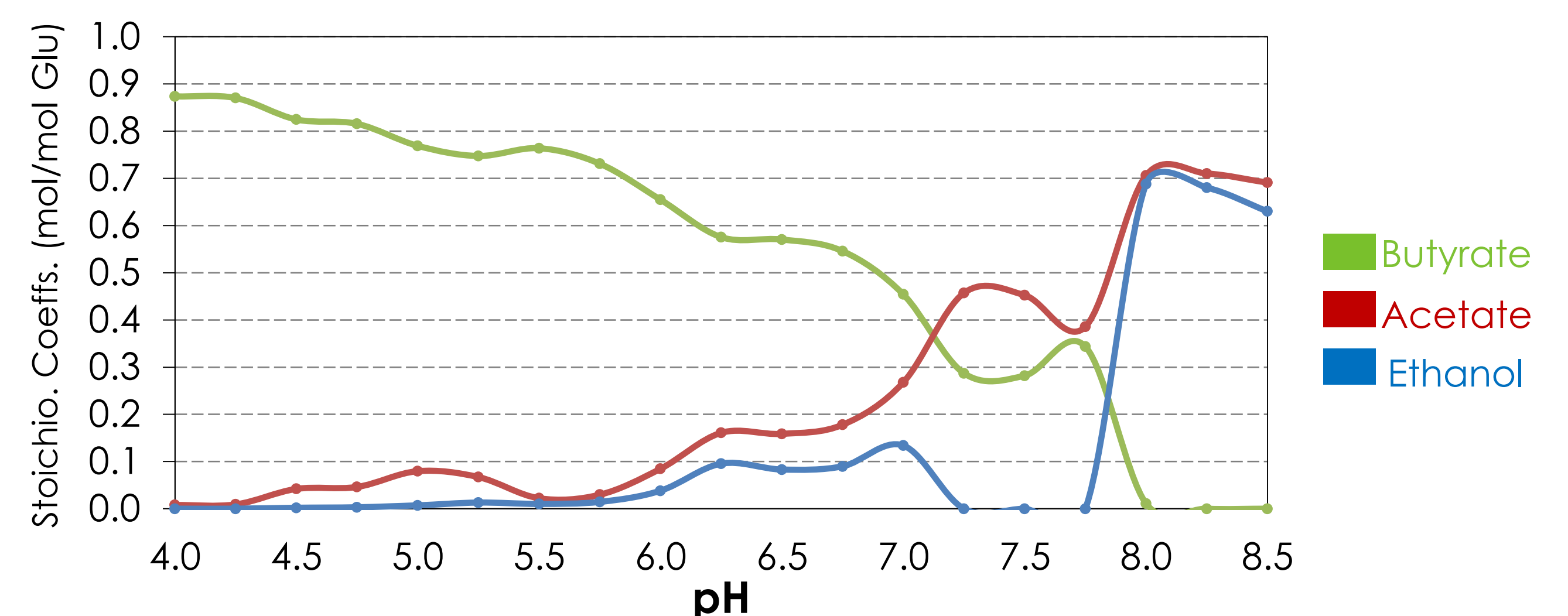


USC: Selecting the operating conditions

Case study: to produce butyrate from a glucose-rich waste (4 g/L)

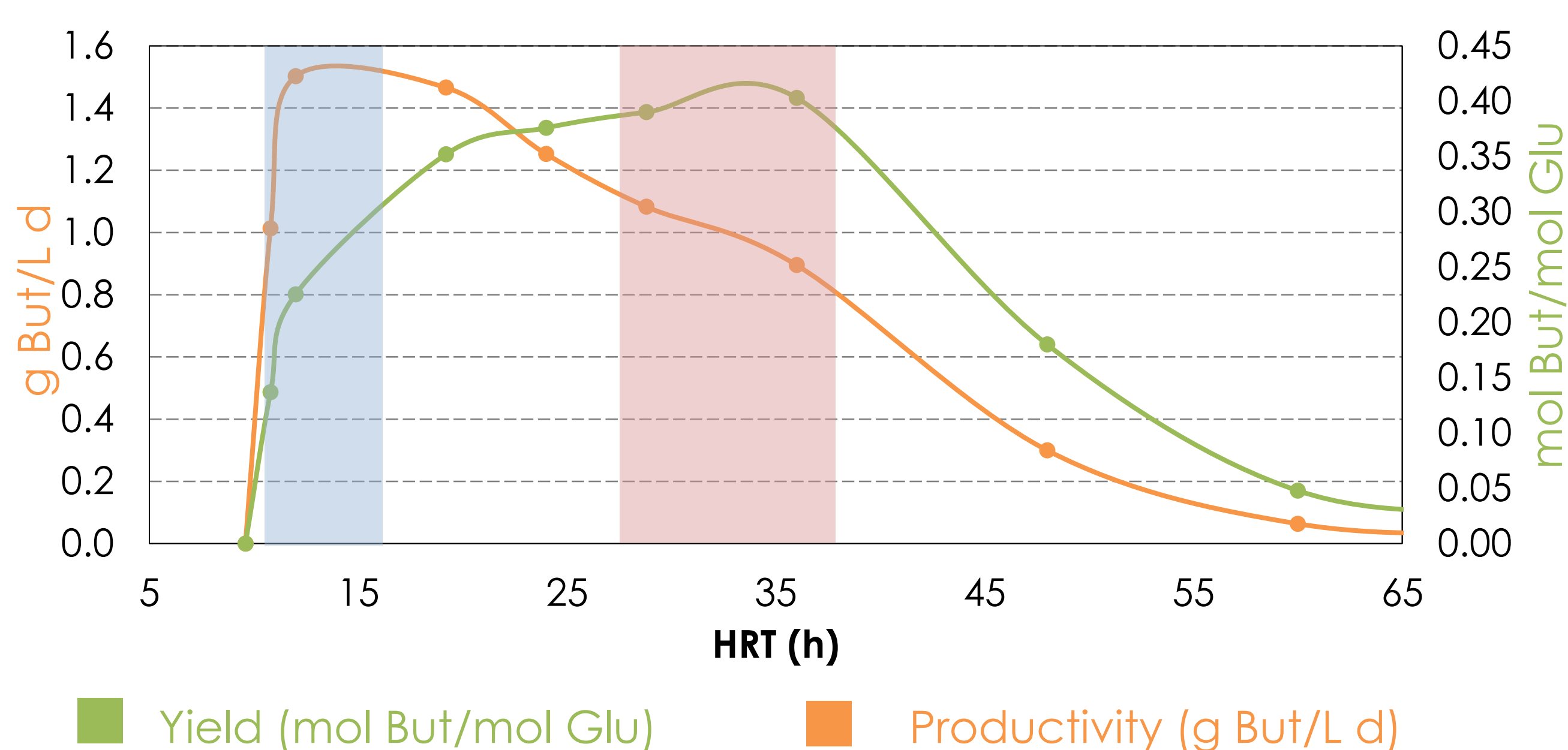


1 Determine the stoichiometry and select the pH with the bioenergetics model

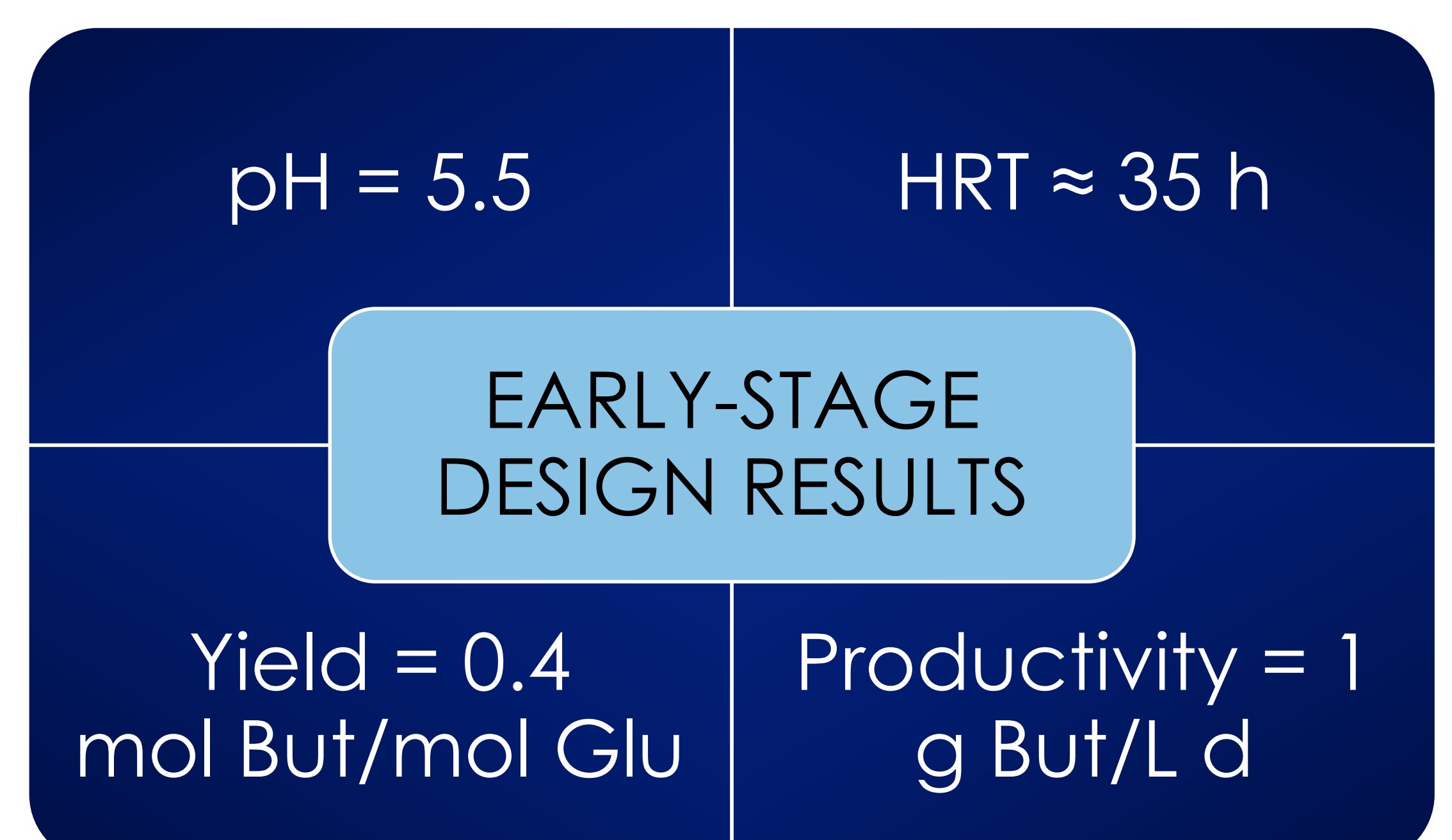


Results from the model suggest to select a pH ≤ 5.5 to ensure a high **butyrate** stoichiometric coefficient.

2 Select the HRT with the kinetic model



Two regions of interest arise from the simulation results:
■ : Maximum productivity. Interesting for very high added-value products
■ : Maximum yield. Appropriate for bulk chemicals and difficult-to-separate products (**butyrate**).



Future perspectives in BIOCHEM

- Including protein and lipids in our models for assessing complex substrates.
- To incorporate separation processes (e.g. In situ Product Recovery) in our modelling framework in collaboration with TUHH.
- The expected end result is a virtual plant for early stage simulation of mixed culture fermentations.

References

González-Cabaleiro *et al.* 2015. Metabolic Energy-Based Modelling Explains Product Yielding in Anaerobic Mixed Culture Fermentations. PLoS ONE, 10. Batstone *et al.* 2002. The IWA Anaerobic Digestion Model No 1 (ADM1). Water Sci Technol, 10, 65-73.

Acknowledgements

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